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Pesticide Fact Sheet Number 19.1: Aldicarb

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This document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the the following actions has occurred.

1. Issuance or reissuance of a registration standard,
2. Issuance of each special review document,
3. Registration of a significantly changed use pattern,
4. Registration of a new chemical, or
5. An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

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Pesticide Fact Sheet

Name of Chemical: ALDICARB
Reason for Issuance: SPECIAL REVIEW PD 2/3
Date Issued: June 22, 1988
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DESCRIPTION OF CHEMICAL

Common Name: Aldicarb

Chemical Name: 2-methyl-2-(methylthio)propionaldehyde O-(methylcarbamoyl)oxime

Class Description: Member of the carbamate family

Trade Name: Temik

EPA Shaughnessy Code: 098301

Chemical Abstracts Service (CAS) Number: 116-06-3

Year of Initial Registration: 1970

Pesticide Type: Insecticide, acaricide, nematicide

U.S. and Foreign Producer: Rhone-Poulenc (formerly Union Carbide Agricultural Chemical Co.)

USE PATTERNS AND FORMULATIONS

Aldicarb is currently registered for use only on cotton, potatoes, citrus, peanuts, soybeans, sugar beets, pecans, tobacco, sweet potatoes, ornamentals, seed alfalfa, grain sorghum, dry beans, and sugar cane.

Types and Methods of Application: Soil incorporated.

Application Rates: 0.3 - 10.0 lbs. active ingredient.

Types of Formulation: Granular formulation (15%, 10%, and 5%). Also as a granular in a mixture with the fungicides pentachloronitrobenzene and 5-ethoxy-3-(trichloromethyl)-1,2,4-thiadiazole.

SCIENCE FINDINGS

Chemical Characteristics: Technical aldicarb is a white crystalline solid with a melting point of 98-100 C (pure material). Under normal conditions, aldicarb is a heat-sensitive, inherently unstable chemical and must be stabilized to obtain a practical shelf-life.

Toxicological Characteristics:

Aldicarb is a carbamate pesticide which causes cholinesterase (ChE) inhibition at very low exposure levels. It is highly toxic by the oral, dermal, and inhalation routes of exposure (Toxicity Category I). The oral LD_{50} value for technical aldicarb is 0.9 mg/kg and 1.0 mg/kg for male and female rates, respectively. The acute dermal LD_{50} for aldicarb in rats is 3.0 mg for males and 2.5 mg for females. Rats, mice and guinea pigs were exposed to aldicarb, finely ground, mixed with talc, and dispersed in the air at a concentration of 200 mg/m^3 for five minutes; all animals died. At a lower concentration (6.7 mg/M^3) a 15 minute exposure was not lethal; however, 5 of 6 animals died during a 30 minute exposure. Exposure of rats for eight hours to air that had passed over technical or granular aldicarb produced no mortality. Aldicarb applied to the eyes of rabbits at 100 mg of dry powder caused ChE effects and lethality.

The toxicity data base for aldicarb is complete. The toxicity data base includes a 2-year rat feeding/oncogenicity study which was negative for oncogenic effects at the no-observed-effect-level (NOEL) of 0.3 mg/kg bw/day; a 100-day dog feeding study and a 2-year dog feeding study with NOELs of 0.7 and 0.1 mg/kg bw/day, respectively, for effects other than cholinesterase inhibition (highest levels tested (HLT)); an 18-month mouse feeding/oncogenicity study with a NOEL of 0.7 mg/kg bw/day which was negative for oncogenic effects at the levels tested (0.1, 0.3, and 0.7 mg/kg bw/day); a 2-year mouse oncogenicity study which was negative for oncogenic effects; a 6-month rat feeding study using aldicarb sulfoxide with a NOEL of 0.125 mg/kg bw/day for ChE inhibition; a 3-generation rat reproduction study with a 0.7 mg/kg bw/day NOEL; a rat teratology study which was negative for teratogenic effects at 0.5 mg/kg bw/day (HLT); a hen neurotoxicity study which was negative at up to 4.5 mg/kg bw/day; a mutagenicity study utilizing the rat hepatocyte primary culture/DNA repair test which was negative for mutagenic effects at 10,000 ug/well; and a mutagenicity test

utilizing an *in vivo* chromosome aberration analysis in Chinese hamster ovary cells which was negative for mutagenic effects at 500 ug/ml.

Physiological and Biochemical Behavioral Characteristics:

Aldicarb and its metabolites are absorbed by plants from the soil and translocated into the roots, stems, leaves, and fruit. The available data indicate that the metabolism of aldicarb in plants and small animals is similar.

Aldicarb is metabolized rapidly by oxidation to the sulfoxide metabolite and followed by a slower oxidation to the sulfone metabolite, which is 25 times less acutely toxic than aldicarb. Both metabolites are subsequently hydrolyzed and degraded further to yield less toxic entities. Available studies demonstrate that the administration of aldicarb to a lactating ruminant results in the rapid metabolism and elimination of the material. No residues of the parent compound and little, if any, residues of aldicarb sulfoxide or aldicarb sulfone are found in the tissues and milk. The predominant residue detected in tissues and milk is aldicarb sulfone nitrile.

Environmental Characteristics:

Sufficient data are available to assess the environmental fate of aldicarb. From the available data, aldicarb has been determined to be mobile in fine to coarse textured soils, even including those soils with high organic matter content, and has been found to reach ground water. Aldicarb is not expected to move horizontally from a bare, sloping field. Therefore, accumulation of aldicarb in aquatic nontarget organisms is expected to be minimal. This is further supported by an octanol/water partition coefficient of 5 and an ecological magnification value of 42.

Ecological Effects:

Aldicarb is highly toxic to mammals, birds, estuarine/marine and freshwater organisms. LC_{50} values for the bluegill sunfish and rainbow trout have been reported as 50 ug/liter and 560 ug/liter, respectively. A LC_{50} of 410.7 ug/liter was reported for *Daphnia magna*. Studies on the toxicity of aldicarb to the mallard duck and the bobwhite quail indicate LD_{50} values of 1.0 and 2.0 mg/kg, respectively.

Limited exposure to mammals is expected from a dietary standpoint. However, data from field studies and the use history of aldicarb provide sufficient information to suggest that application of this pesticide may result in some mortality, with possible local population reductions of some avian species. Whether these effects are excessive, long-lasting, or likely to diminish wildlife resources cannot be stated with any degree of certainty. Therefore, additional field studies have been required to further quantify the impact on avian and small mammal populations. Field study results will be submitted in April 1988.

Aldicarb has also been found to pose a threat to the endangered Attwaters Greater Prairie Chicken, living in or near aldicarb-treated fields. Accordingly, all aldicarb products are required to bear labeling restrictions prohibiting the use of the product in the Texas counties of Aransas, Austin, Brazoria, Colorado, Galveston, Goliad, Harris, Refugio, and Victoria if this species is located in or immediately adjacent to the treatment area.

Tolerance Assessment:

The Agency is in the process of reassessing the existing tolerances for aldicarb. Processing studies for coffee and potatoes have been submitted and are acceptable. A large animal metabolism study has been submitted to the Agency and satisfies the data requirement. A completed study of aldicarb residues on soybean processing fractions is to be submitted by August 1988. The requirement to submit a study analyzing aldicarb residues on treated cotton forage has been satisfied with a label restriction prohibiting the feeding of treated forage to livestock.

Exposure Incidents:

In 1979, aldicarb residues were found in drinking water wells located near aldicarb treated potato fields in Suffolk County, Long Island, New York, at levels greater than 200 parts per billion (ppb). Subsequently, aldicarb has been detected in ground water in 48 counties within 15 other States at levels up to 515 ppb. In all, the Agency has evaluated over 35,000 ground water samples of which 32% were positive for residues of aldicarb. The Agency's Office of Drinking Water (ODW) has established a Health Advisory level (HA) of 10 ppb for residues of aldicarb in drinking water.

The Pesticide Incident Monitoring System (PIMS) reports on aldicarb, from 1966 through 1982, contained 165 incidents

associated with human injury. Most of the human incidents alleged that aldicarb was the cause of the problem, but there was insufficient evidence to support such a conclusion. Those incidents involving confirmed aldicarb poisonings appeared to be the result of failure to use label recommended safety equipment while applying aldicarb. Other incidents resulted from accidental spillage, ingestion of aldicarb, or consumption of food commodities improperly treated with aldicarb.

The largest documented episode of foodborne pesticide poisoning in North American history occurred in July 1985 from aldicarb-contaminated California watermelons. More than a thousand probable cases were reported from California, Oregon, Washington, Alaska, Idaho, Nevada, Arizona and Canada. The spectrum of illness attributed to aldicarb ranged from mild to severe and included cases of grand mal seizures, cardiac arrhythmias, severe dehydration, bronchospasms, and at least two stillbirths occurring shortly after maternal illness. The prompt embargo of watermelons on July 4, 1985 abruptly terminated the major portion of the outbreak and reported illnesses occurring after the implementation of the watermelon certification program were far fewer and milder in comparison to earlier cases. Contamination of the watermelons ranged up to 3.3 ppm of aldicarb sulfoxide (ASO), a metabolite of aldicarb. Clinical signs occurred from exposures to dosages estimated to be as low as 0.0026 mg/kg ASO.

SUMMARY OF REGULATORY POSITION AND RATIONALE

a. Dietary Exposure to Treated Food Commodities

The Agency has recently received the final results of a National Food Survey which monitored raw agricultural commodities for residues of aldicarb in the market place. After these data have been evaluated, the dietary exposure from consuming treated food commodities will be estimated, and a risk assessment will be conducted. The Agency may propose further regulatory action depending on the results of this study.

b. Dietary Exposure to Contaminated Ground Water

The Agency has concluded that there are unacceptable risks to persons consuming drinking water that is contaminated with aldicarb at levels greater than the HA of 10 ppb due to a reduced margin of safety for ChE inhibition.

The Agency cannot identify all specific areas of the nation where aldicarb residues exceed the HA, or the number of people who would be exposed to these high levels of contamination. However, the Agency can predict certain areas of the nation where the ground water supplies have a relatively high vulnerability to aldicarb contamination due to the hydrogeology and/or agronomic practices found in that area. Additionally, the Agency can predict certain areas which would have a medium vulnerability to contamination, although the vulnerability within some of these areas could vary greatly with some areas being much more vulnerable.

It is the Agency's presumption that the risks posed by aldicarb contamination of ground water above the HA in current or potential drinking waters will likely be more significant, in almost all cases, than any local benefit derived from aldicarb's continued use. Consequently, the Agency is proposing to regulate the use of aldicarb in order to eliminate or prevent contamination of ground water at levels above the HA. As a basic level of protection for all areas where aldicarb is used, the Agency is proposing a number of restrictions on the label. Specifically, no use of aldicarb would be permitted within 300-feet of a drinking water well, and aldicarb would be classified as a restricted use pesticide due to ground water concerns. (Aldicarb is already classified as a restricted use pesticide due to its acute toxicity.) Additionally, the Agency is seeking public comment as to what, if any, additional measures should be considered regarding the use of aldicarb and site-conditional restrictions.

The Agency will also require monitoring in those areas classified as having a medium tendency to leach. The data generated will be used to determine whether further regulatory action is required in these areas.

Finally, for those areas where there is the greatest likelihood of ground water contamination, states will need to implement, either for the entire state or for a county(ies) within the state, State Pesticide Ground Water Management Plans (MPs). Briefly, MPs are comprehensive plans which describe the measures states will impose to prevent ground water contamination. The Agency believes that MPs provide the best method of protection ground water pesticide contamination.

The Agency is soliciting public comment on a number of issues regarding its preliminary determination for aldicarb. Included are questions regarding the components of an MP, which assessment (hydrogeologic region or county) should be used in identifying those areas where contamination is most likely to occur, how should a localized risk/benefit analysis be performed and who should conduct it, and who is responsible for the costs associated with cleaning up ground water contamination.

CONTACT PERSON

Bruce Kapner
Special Review Branch, Registration Division
Office of Pesticide Programs (TS-767C)
401 M Street, S.W.
Washington, D.C. 20460
(703) 557-1170

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